UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/728,649	12/05/2003	Perry H. Wang	42P17015	8436

8791   7590   01/12/2009
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER
TANG, KENNETH

ART UNIT	PAPER NUMBER
2195	

MAIL DATE	DELIVERY MODE
01/12/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
Office Action Summary	10/728,649	WANG ET AL.
	Examiner	Art Unit	
	KENNETH TANG	2195	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>06 November 2008</u>.

2a)☒ This action is FINAL. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-30</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-30</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 1-30 are presented for examination.

2.   This action is in response to the Amendment/Remarks on 11/6/08. Applicant's

arguments have been fully considered but are moot in view of the new grounds of rejections.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the
subject matter which the applicant regards as his invention.

3.   Claims 1-13, 25 and 30 are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

        a.   As to claim 1, the term "light-weight" is a relative term which renders the claim

        indefinite. The term "light-weight" is not defined by the claim, the specification does not

        provide a standard for ascertaining the requisite degree, and one of ordinary skill in the

        art would not be reasonably apprised of the scope of the invention. Claims 2-13 are also

        rejected as being dependent upon rejected claim 1.

        b.   As to claim 25, the term "minimal context information" (line 3) is a relative term

        which renders the claim indefinite. The term "minimal context information" is not

        defined by the claim, the specification does not provide a standard for ascertaining the

        requisite degree, and one of ordinary skill in the art would not be reasonably apprised of

        the scope of the invention. Furthermore, there lacks antecedent basis for "the minimal

        context information". It is unclear how the minimal context information is restored being

that it is not clear how the minimal context information was initially used in the first

place.

c.   Claim 30 recites the limitation "the user-marking instruction" in line 5. There is

insufficient antecedent basis for this limitation in the claim. Claim 30 depends on claim

28, but it is unclear if it should depend on claim 29 because that claim does have

antecedent basis. Since the scope of the claim cannot be ascertained, the claim is found

to be indefinite.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on
sale in this country, more than one year prior to the date of application for patent in the United States.

4.   **Claims 14-16 and 18-20 are rejected under 35 U.S.C. 102(b) as being anticipated by**

Wang et al. (hereinafter Wang) (US 2002/0144083 A1).

5.   As to claim 14, Wang teaches a system comprising:

a memory to hold an instruction (registers) (page 3, [0044], lines 1-10); and

a processor coupled to the memory (registers are coupled to the processor) (Fig. 1, items

100, 102, 112), including raw event detection logic to detect at least one raw event, a user-

addressable register to specify a user-defined trigger event based on the at least one raw event, a

switch handler to invoke a helper thread (spawning a speculative thread via an event trigger)

responsive to the occurrence of the user-defined trigger event (page 2, [0030], Abstract, page 3,

[0047], page 5, [0065]).

6.   As to claim 15, Wang teaches wherein: the instruction includes a marking instruction,

when executed, to specify the user-defined trigger event in the user-addressable register (page 4,

[0055], lines 1-8).

7.   As to claim 16, Wang teaches wherein: the instruction is a trigger instruction; and raw

event detection logic is to detect an opcode of the trigger instruction when the trigger instruction

reaches an execution phase of an execution pipeline (page 2, [0032] and [0037]).

8.   As to claim 18, Wang teaches wherein: the switch handler is further to maintain minimal

context information for a current thread before invoking the helper thread, wherein the minimal

context information includes a context weight less than a full context weight by at least a weight

of excluding traditional context information (context switching without incurring any overhead

cycles) (page 4, [0061]).

9.   As to claim 19, Wang teaches wherein: the excluded traditional context information

further comprises general register values (page 3, [0044]).

10.   As to claim 20, Wang teaches wherein the minimal thread context information comprises

an instruction pointer address value (page 6, [0085], lines 5-9).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

11.   Claims 1-7 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Jones et al.

(hereinafter Jones) (US 2005/0107986 A1).

12.   As to claim 1, Wang teaches an apparatus comprising:

a trigger-response mechanism that includes at least one bank of user-programmable

registers to identify a user-defined trigger event (page 3, [0044], page 2, [0030]); and

thread switch handler logic coupled to the trigger-response mechanism to perform a light-

weight thread (threads are by definition light-weighted vs. processes are heavy-weighted) switch

from a first thread to a second thread (switching from main thread to the spawned speculative

thread via triggers) (Abstract, page 4, [0055], page 5, [0065]).

13.   Wang is explicitly silent that the thread switching occurs responsive to the user-defined

trigger event occurring during execution of the first thread. However, Jones teaches thread

switching being done responsive to user-defined trigger events occurring during execution of the

first thread via the use of user-programmable registers ([0023]-[0026]). Wang and Jones are

analogous art because they are both in the same field of endeavor of thread processing. One of

ordinary skill in the art would have known to modify Wang such that it would include the feature

of the thread switching responsive to the user-defined trigger event occurring during execution of

the first thread, as taught in Jones. The suggestion/motivation for doing so would have been to

provide the predicted result of an improved performance monitoring, as disclosed in Jones

([0003], [0009]). Therefore, it would have been obvious to one of ordinary skill in the art to

combine Wang and Jones to obtain the invention of claim 1.

14.   As to claims 2-3, Wang is silent in synchronous and asynchronous triggering of events.

However, Official Notice is taken that synchronous and asynchronous processing are well known

and with each having distinct advantages. For example, asynchronous processing returns control

to the user program without waiting for an I/O to complete. The I/O then can continue while

other system operations occur. On the other hand, synchronous processing returns the control to

the user process and is more simpler than asynchronous processing. It would have been obvious

to one of ordinary skill in the art at the time the invention was made to modify Wang to include

the features of synchronous and asynchronous processing to achieve the benefit as described
above.

15.   As to claim 4, Wang (page 4, [0064]) and Jones (see Fig. 3) teaches wherein the thread
switch handler logic to perform a light-weight switch from the first thread to the second thread
comprises: saving a first instruction pointer address for the first thread before setting a second
instruction pointer address for the second thread. In a context switch, the state of the first
process must be saved somehow, so that, when the scheduler gets back to the execution of the
first process, it can restore this state and continue.

16.   As to claim 5, Wang further comprising: a task queue to receive the first instruction
pointer address (Fig. 1, item 110, [0080], [0085]).

17.   As to claim 6, Wang teaches wherein: the task queue further comprises a memory
location (page 3, [0044]).

18.   As to claim 7, Wang teaches wherein: the task queue further comprises a register (page 3,
[0044]).

19.   As to claim 10, Wang teaches wherein the thread switch handler logic is to perform the
light-weight thread switch from the first thread to the second thread transparently to an Operating
System (OS) and without OS intervention. (page 5, [0065], page 4, [0064]).

20.   As to claim 11, Wang teaches wherein: the thread switch handler is further to save a light
weight context for the first thread in a memory location before performing the light-weight
context switch from the first thread to the second thread (page 3, [0044]). In a context switch,
the state of the first process must be saved somehow, so that, when the scheduler gets back to the
execution of the first process, it can restore this state and continue.

21.   As to claim 12, Wang teaches wherein: the thread switch handler is further to save a light
weight context for the first thread in a register before performing the light-weight context switch
from the first thread to the second thread (page 3, [0044]). In a context switch, the state of the
first process must be saved somehow, so that, when the scheduler gets back to the execution of
the first process, it can restore this state and continue.

22.   **Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et
al. (hereinafter Wang) (US 2002/0144083 A1) in view of Jones, and further in view of Hugly
(US 2002/0138706 A1).**

23.   As to claim 8, Although Jones discloses the prevention of problems from non-atomic

processor events detected by counters ([0012], [0040]), Jones and Wang are explicitly silent in

further comprising: a plurality of event counters coupled to the trigger-response mechanism,

wherein each event counter is to detect an atomic processor event. However, Hugly teaches

exception handling and context switching wherein a plurality of event counters are coupled to the

switching mechanism, wherein each event counter detects an atomic processor event ([0041]-

[0043], [0045]). One of ordinary skill in the art would have known to modify Wang and Jones to

include using a plurality of event counters. The motivation/suggestion for doing so would have

been to improve the handling of any access conflicts, thus improving control and reducing

overheard, as stated in Hugly ([0008]). Therefore, it would have been obvious to combine Hugly

with Wang and Jones to obtain the invention of claim 8.

24.   As to claim 9, Hugly teaches trigger events being based on one or more of the atomic

processor events ([0041]-[0043], [0045]).

25.   Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al.

(hereinafter Wang) (US 2002/0144083 A1) in view of Jones et al. (hereinafter Jones) (US

2005/0107986 A1), and further in view of Spix et al. (hereinafter Spix) (US 6,195,676).

26.   As to claim 13, Wang teach further comprising: one or more user-programmable control

registers coupled to the thread switch handler (see rejection of claim 1). Wang and Jones are

silent in teaching the value of the one or more control registers to indicate the weight of context

information. However, Spix teaches context switching wherein the amount of context

information in the registers are indicated and classified as lightweight, for example (col. 3,lines

9-35, col. 14, lines 66-67 through col. 15, lines 1-6). One of ordinary skill in the art would have

known to modify Wang and Jones to include Spix's feature of identifying weights of context

information for the use of context switching. The motivation/suggestion for doing so would

have been to minimize total context switch overhead and minimizing the delays and bottlenecks

by classifying the amount of context information (weights) and context switching according to

those weights (col. 3,lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). Therefore, it

would have been obvious to combine Jones, Wang and Spix to obtain the invention of claim 13.

27.   **Claims 17 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over**
Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Spix et al. (hereinafter
Spix) (US 6,195,676).

28.   As to claim 17, Wang teach further comprising: one or more user-programmable control

registers coupled to the thread switch handler (see rejection of claim 1). Wang is silent in

teaching the value of the one or more control registers to indicate the weight of context

information. However, Spix teaches context switching wherein the amount of context

information in the registers are indicated and classified as lightweight, for example (col. 3,lines

9-35, col. 14, lines 66-67 through col. 15, lines 1-6). One of ordinary skill in the art would have

known to modify Ahmad and Ranganathan to include Spix's feature of identifying weights of

context information for the use of context switching. The motivation/suggestion for doing so

would have been to minimize total context switch overhead and minimizing the delays and

bottlenecks by classifying the amount of context information (weights) and context switching

according to those weights (col. 3,lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6).

Therefore, it would have been obvious to combine Spix with Wang to obtain the invention of

claim 17.

29.   As to claim 28, Wang teaches a processor comprising:

event detection logic to detect a raw event (switch-on-event based on event triggers)

(page 2, [0030], [0047]);

user-programmable event logic coupled to the event detection logic to indicate a user-

defined trigger event, the user-defined trigger event to be based on at least the raw event (page 2,

[0030], page 5, [0065]);

thread switch logic coupled to the user-programmable event logic and context control

logic, the thread switch logic, in response the user-defined trigger event being detected, to save a

portion of a first context to be saved that is to be specified in the user-programmable context

control logic and to spawn a helper thread without operating system intervention (page 5, [0064]-

[0065]).

30.   Want is silent in taking into consideration the weight of the context. However, Spix

teaches context switching wherein the amount of context information in the registers are

indicated and classified as lightweight, for example (col. 3,lines 9-35, col. 14, lines 66-67

through col. 15, lines 1-6). One of ordinary skill in the art would have known to modify Ahmad

and Ranganathan to include Spix's feature of identifying weights of context information for the

use of context switching. The motivation/suggestion for doing so would have been to minimize

total context switch overhead and minimizing the delays and bottlenecks by classifying the

amount of context information (weights) and context switching according to those weights (col.

3,lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). Therefore, it would have been

obvious to combine Spix with Wang to obtain the invention of claim 28.

31.   As to claim 29, Wang teaches wherein the user-programmable event logic includes at

least a user-programmable event register, and wherein the user-defined trigger event is to be

programmed in the user-programmable event register in response to execution of a user marking

instruction (page 4, [0055]). In addition, Spix teaches the use of marking instructions in event

processing (col. 45, lines 37-53).

32.   As to claim 30, Wang teaches further comprising trigger response logic coupled to the

user-programmable event logic and the event detection logic to detect the user-defined trigger

event based on at least the raw event, wherein the trigger response logic is to monitor for the

user-defined trigger event for a predetermined timeout period after execution of the user-marking

instruction (page 3, [0047], lines 6-20).

33.   **Claims 21-23 and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable**

over Kissell (US 2005/0050395 A1) in view of Jones et al. (hereinafter Jones) (US

2005/0107986 A1).

34.   As to claim 21, Kissell teaches a method comprising:

detecting a trigger condition (a miss occurrence or if thread 212 stalls, for example) (page

1, [0011], lines 14-23);

suspending execution of a first thread on a single-threaded processor (thread to be

suspended and another thread activated) (page 2, [0014], lines 3-4);

utilizing hardware to save minimal context information (minimum possible overhead) for

the current thread without operating system intervention (page 2, [0020], lines 4-8); and

invoking a second thread on the single-threaded processor without operating system

intervention (creating thread by using a FORK command or switching from one thread to

another) (page 2, [0020], lines 6-10, page 1, [0013], lines 2-4).

35.   Wang is explicitly silent that the thread switching from a first thread to a second thread

happens wherein the context information has a first weight that is user-defined in a user-

addressable control register. However, Jones teaches thread switching being done responsive to
user-defined trigger events occurring during execution of the first thread via the use of user-
programmable registers ([0023]-[0026]). Kissell and Jones are analogous art because they are
both in the same field of endeavor of thread processing. One of ordinary skill in the art would
have known to modify Kissell such that it would include the feature of the thread switching
responsive to the user-defined trigger event occurring during execution of the first thread, as
taught in Jones. The suggestion/motivation for doing so would have been to provide the
predicted result of an improved performance monitoring, as disclosed in Jones ([0003], [0009]).
Therefore, it would have been obvious to one of ordinary skill in the art to combine Kissell and
Jones to obtain the invention of claim 21.

36.   As to claims 22-23 and 26, Kissell teaches wherein: detecting a user-specified trigger
condition further comprises determining that an asynchronous condition specified in a marking
instruction (privileged instruction, etc.) has been encountered (page 6, [0093] and [0097]). Jones
discloses the prevention of problems from non-atomic processor events detected by counters
([0012], [0040]).

37.   As to claim 25, Kissell teach further comprising: determining that the first thread should
be resumed; restoring the minimal context information for the first thread; and resuming
execution of the first thread without operating system intervention (page 5, [0085], page 6,
[0104], lines 1-13).

38.   As to claim 27, Kissell teaches wherein detecting a user-specified trigger condition

further comprises: generating an asynchronous response to indicate that the second thread should

be invoked (page 6, [0093]).

39.   Claim 24 is rejected under 35 U.S.C. 102(e) as being unpatentable over Kissell (US

2005/0050395 A1) in view of Jones et al. (hereinafter Jones) (US 2005/0107986 A1), and

further in view of Saville et al. (hereinafter Saville) (US 6,401,155 B1).

40.   As to claim 24, Kissell and Jones are silent wherein the first weight includes only an

instruction pointer address. However, Saville teaches that it is well known that by storing in

memory locations not contexts themselves, but pointers to the contexts, this provides a high

degree of versatility. It also enables memory to be conserved by storing in only one memory

location a context which have common context (col. 2, lines 5-16). Therefore, it would have

been obvious to one of ordinary skill in the art to modify Kissell and Jones such that the first

weight would include only an instruction pointer address, as taught in Saville. The

suggestion/motivation for doing so would have been to provide the predicted result of increased

versatility as well as improved memory management, as taught in Saville (col. 2, lines 5-16).

Therefore, it would have been obvious to one of ordinary skill in the art to combine Kissell,

Jones, and Saville to obtain the invention of claim 24.

Response to Arguments

41.   During patent examination, the pending claims must be "given their broadest reasonable

interpretation consistent with the specification." *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d

1664, 1667 (Fed. Cir. 2000). Applicant always has the opportunity to amend the claims during

prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once

issued, will be interpreted more broadly than is justified. *In re Prater*, 415 F.2d 1393, 1404-05,

162 USPQ 541, 550-51 (CCPA 1969).

42.   Applicant's amendments to the claims have overcome the claim objections.

43.   Applicant's amendments to the claims have overcome most of the 35 USC 112, 2nd

paragraph rejections from the previous office action. However, the amendments have prompted

new grounds of rejections based on 35 USC 112 2nd paragraph with regards to claims 1-13, 25

and 30 (see rejection above).

44.   Applicant's arguments have been fully considered but are moot in view of the new

grounds of rejections.

45.   Applicant's amendment to the claims prompted new grounds of rejections, which render

the remaining arguments moot.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure:

- **Gaertner et al. (US 5,390,329)** discloses maintaining minimal context

    information in context switching system with the benefit of processing switches

    economically (see Abstract).

- **DeBruler (US 4,539,637)** discloses that is well known to store only the address of

    the program function context, and to store the address of the program function, or

    a pointer to such an address, in the program function context (col. 12, lines 28-

    31).

- **Hass (US 2005/0044323 A1)** discloses the use of user-programmable registers in

    thread switching (see claims 8, 11, 14).

- **Moyer et al. (US 2003/0226001 A1)** discloses the user of user-programmable

    registers in thread switching (see Abstract, [0020]).

Applicant's amendment necessitated the new ground(s) of rejection presented in this

Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNETH TANG whose telephone number is (571)272-3772. The examiner can normally be reached on 8:30AM - 6:00PM, Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai An can be reached on (571) 272-3756. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/VAN H NGUYEN/   /Kenneth Tang/
Primary Examiner, Art Unit 2194   Examiner, Art Unit 2195